NSTB

National SCADA Test Bed

enhancing control systems security in the energy sector

Visualization and Controls Program Peer Review 2006 AGA 12 Cryptographic Security Analysis

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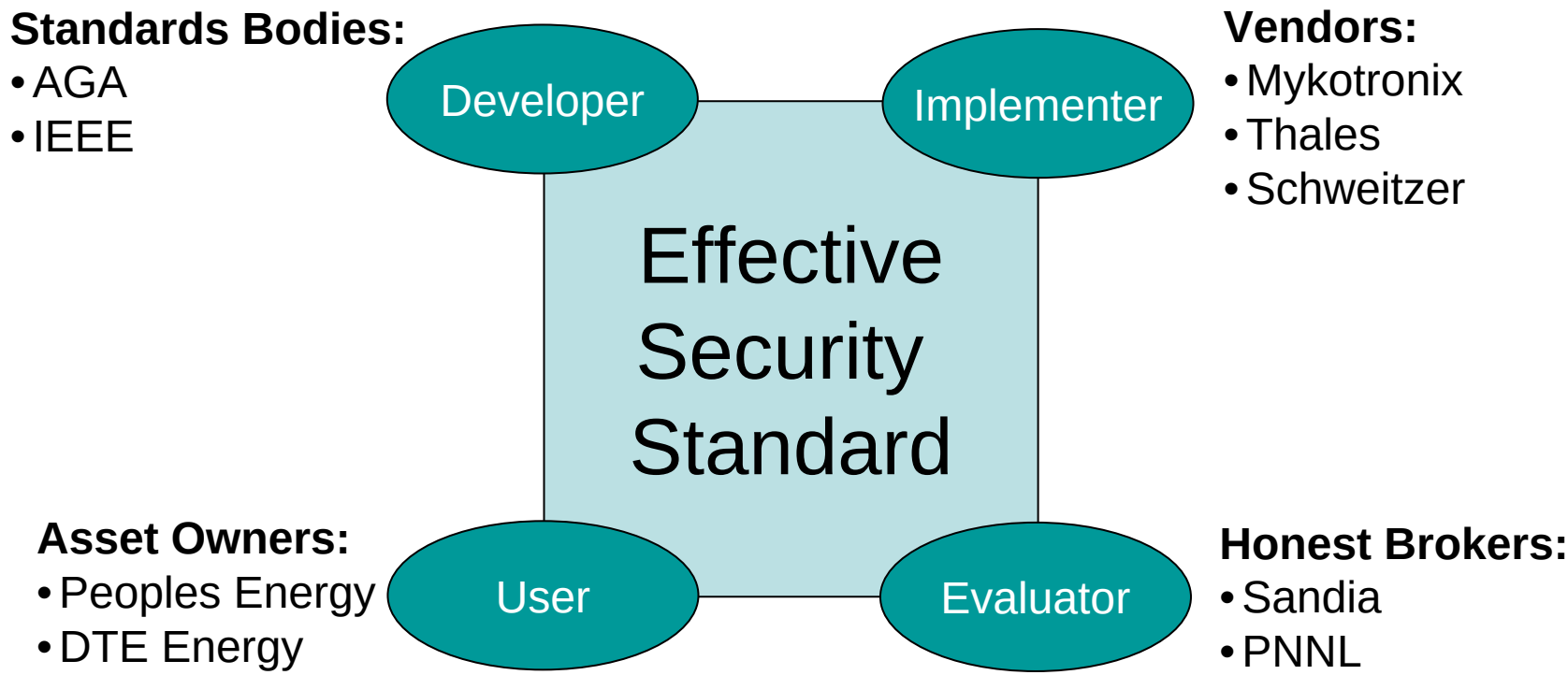
Work Package Description

- NSTB FY05 Task
  - AGA 12: *Cryptographic Protection of SCADA Communications*
    - Part 1: Background, Policies, and Test Plan
    - Part 2: Retrofit Link Encryption for Asynchronous Serial Communications
    - Part 3: Protection of Networked Systems
    - Part 4: Protection Embedded in SCADA Components
  - Task 1: AGA 12, Part 2 Cryptographic Security Analysis
    - *AGA 12, Part 2 Cryptographic Security Analysis* report delivered June, 2006
  - Task 2: AGA 12, Part 2 Cryptographic Security Testing
    - *SCADA Cryptographic Security Test Plan: General Guidance* delivered June, 2006

Industry Needs

- Asset owners need SCADA security products they can trust
  - Trust can come from Honest Broker evaluation
- Vendors need a stable security standard for development



Industry Benefits (Impacts)

- Original draft reviewed
  - May 12, 2005
- Recommendations had limited impact on intermediate drafts
  - November 29, 2005
  - January 25, 2006
- Final recommendations had huge impact on most recent draft
  - March 31, 2006

Technical Approach

- Cryptographic Security Analysis and Testing
  - Studied multiple drafts of AGA 12, Part 2
  - Engaged AGA 12, Part 2 authors in technical discussions via email and telephone to increase our understanding.
  - Developed block diagrams / flow charts of AGA 12, Part 2 protocols
  - Studied cryptographic algorithms and their uses as specified by AGA 12, Part 2
  - Documented security findings and recommendations
  - Reported findings and recommendations to AGA 12, Part 2 authors
  - Prepared final report based on findings, recommendations, and changes to AGA 12, Part 2
  - Prepared general guidance for testing SCADA security devices

Collaborations and Partnerships

- GTI
  - Bill Rush: Lead contact / editor of AGA 12
  - John Kinast: AGA 12 author
  - Aakash Shah: AGA 12 software implementer / tester
- Cisco
  - Andrew Wright: Lead technical author of AGA 12
- AGA
  - Host body for AGA 12
- PNNL
  - Mark Hadley: AGA 12 device performance testing

Technical Progress – Accomplishments

- Created diagrams for Serial SCADA Protection Protocol
  - Session Layer, Transport Layer
  - OPN, ACK, CLS, ERR Messages
- Cryptographic Security Findings / Recommendations
  - Static Session – used to transfer Dynamic session keys
    - Use of stream ciphers for Static Sessions should be prohibited
    - The state variable (32-bit random number) is too short
    - 64-128 bits of state variable recommended
  - Attacks against PE Mode with No Holdback
    - Block swapping is possible without CRC detection
    - Repeated state variables defeats CRC check
  - Perform Full Holdback Authentication of dynamic session headers
  - Rewrite standard to promote consistent, secure implementations

Technical Progress – Accomplishments

- Final Reports
  - AGA 12 Part 2 Cryptographic Security Analysis
    - Official Use Only
  - SCADA Cryptographic Security Test Plan: General Guidance
- Impact
  - Greatly increased the security of AGA 12